Supplementary Online Content

Cho JY, Han H-S, Choi Y, et al. Association of remnant liver ischemia with early recurrence and poor survival after liver resection in patients with hepatocellular carcinoma. *JAMA Surg*. Published online January 4, 2017. doi:10.1001/jamasurg.2016.5040

This supplementary material has been provided by the authors to give readers additional information about their work.

eTable 1. Types of Resection According to the Severity of Remnant Liver Ischemia

	No. of Patients	Minimal Ischemia	Severe Ischemia
Major hepatectomy	105	70 (66.7%)	35 (33.3%)
Right hepatectomy	69	55 (79.7%)	14 (20.3%)
Left hepatectomy	19	10 (52.6%)	9 (47.4%)
Central bisectionectomy	17	5 (29.4%)	12 (70.6%)
Minor hepatectomy	223	160 (71.7%)	63 (28.3%)
Right posterior sectionectomy	38	28 (73.7%)	10 (26.3%)
Right anterior sectionectomy	8	5 (62.5%)	3 (37.5%)
Left lateral sectionectomy	34	30 (88.2%)	4 (11.8%)
Bisegmentectomy	4	3 (75.0%)	1 (25.0%)
Caudate lobectomy	4	3 (75.0%)	1 (25.0%)
Segmentectomy*	46	29 (63.0%)	17 (37.0%)
Tumorectomy	89	62 (69.7%)	27 (30.3%)

*Segmentectomy included 23 patients who underwent anatomical mono-segmentectomy and 23 patients who underwent non-anatomical segmenctectomy.

eTable 2. Univariate Analysis of Risk Factors for Severe Remnant Liver Ischemia After Hepatectomy

	Minimal Ischemia (n = 230)	**Severe Ischemia (n = 98)**	***P* Value**
Age, years (mean ± SD)	57.8 ± 11.1	58.9 ± 11.1	.432
Sex (M : F)	172:58	80:18	.178
Previous TACE, n (%)	61 (26.5%)	39 (39.8)	.017
Previous radiofrequency ablation, n (%)	13 (5.7%)	8 (8.2%)	.395
Child–Pugh classification (A: B: C)	212: 13: 5	80: 11: 7	.015
Previous history of surgery, n (%)	40 (17.4%)	13 (13.3%)	.353
Tumor size, cm (mean ± SD)	3.9 ± 2.9	4.5±2.8	.108
Histological cirrhosis, n (%)	133 (57.8%)	65 (66.3%)	.150
Laparoscopic surgery, n (%)	140 (60.9%)	52 (53.1%)	.189
Major hepatectomy, n (%)	70 (30.4%)	35 (35.7%)	.617
Anatomical resection, n (%)	146 (63.5%)	62 (63.3%)	.971
Preoperative albumin, mg/dl (mean ± SD)	4.1 ± 0.4	3.9 ± 0.5	.009
Preoperative bilirubin, mg/dl (mean ± SD)	0.9 ± 0.7	0.9 ± 0.6	.835
Preoperative prothrombin time, INR (mean ± SD)	1.08 ± 0.11	1.10 ± 0.12	.272
Preoperative AST, mg/dl (mean ± SD)	38.7 ± 27.4	52.3 ± 77.1	.092
Preoperative ALT, mg/dl (mean ± SD)	38.8 ± 32.1	50.9 ± 55.6	.046
Preoperative platelet count, $\times 10^3/\mu l$ (mean ± SD)	164.7 ± 67.7	158.1 ± 63.8	.415
ICGR15, % (mean ± SD)	11.3 ± 19.2	10.1 ± 6.6	.590
Pringle maneuver, n (%)	39 (17.0%)	28 (28.6%)	.049
Pringle duration, min (mean ± SD)	30.3 ± 15.6	33.4 ± 17.7	.452
Blood loss, ml (mean ± SD)	886.4 ± 1408.9	1682.2 ± 2699.4	.007
Transfusion, n (%)	55 (23.9%)	40 (40.8%)	.002
Operation time, min (mean ± SD)	276.8 ± 137.0	368.7 ± 182.5	<.001
Pathologic margin, cm (mean ± SD)	**1.28 ±1.2**	**1.2 ± 1.3**	**.406**

SD, standard deviation; M, male; F, female; TACE, transarterial chemoembolization; INR, international normalized ratio; AST, aspartate aminotransferase; ALT, alanine aminotransferase; ICGR15, indocyanine green retention rate at 15 min.

eTable 3. Univariate Analysis of Prognostic Factors for Overall Patient Survival and Disease-Free Survival

Variable	Factor (No. of Patients)	OS, Median (months)	*P* Value	DFS, Median (months)	*P* Value
Sex	Male (252)	88.1	.255	47.7	.041
	Female (76)	92.2		60.2	
Age	≤ 60 years (190)	95.1	.055	50.3	.951
	> 60 years (138)	79.2		51.0	
Remnant liver ischemia	Minimal (230)	106.3	<.001	65.6	<.001
	Severe (98)	46.9		13.2	
pT	≤ 2 (285)	94.3	<.001	53.1	.001
	≥ 3 (43)	53.7		31.3	
Previous TACE	No (226)	92.5	.237	52.6	.038
	Yes (1032)	81.5		42.3	
Previous RFA	No (307)	89.5	.439	52.1	.194
	Yes (21)	94.5		37.7	
Child–Pugh classification	A (292)	94.1	<.001	52.1	.223
	B or C (36)	61.0		38.7	
Laparoscopic surgery	No (136)	74.9	.001	44.8	.137
	Yes (192)	97.3		52.5	
Pringle maneuver	No (260)	85.5	.818	49.2	.707
	Yes (68)	90.6		49.7	
Transfusion	No (233)	96.7	.020	42.9	.285
	Yes (95)	73.9		53.3	
Anatomical resection	Anatomical (208)	89.5	.907	55.0	.030
	Non-anatomical (120)	85.7		41.2	
Satellite nodule	No (285)	92.9	.013	64.3	<.001
	Yes (43)	71.1		26.4	
Microvascular invasion	No (207)	93.7	.028	57.3	.004
	Yes (119)	76.8		38.4	
Gross type	Expanding nodular (200)	97.8	<.001	57.1	.007
	Multinodular confluent (117)	68.9		36.5	
	Infiltrative (10)	35.0		20.5	
Serosal invasion	No (219)	92.7	.138	49.6	.501
	Yes (106)	74.5		51.8	
E–S grade	I / II (191)	93.5	.064	52.2	.245
	III / IV (137)	81.3		47.1	
Histologic cirrhosis	No (130)	92.2	.042	57.4	.102
	Yes (198)	84.5		44.9	
α-fetoprotein	< 400 ng/ml (251)	90.4	.497	50.9	.990
	≥ 400 ng/ml (76)	88.7		49.7	

ICGR15	< 10 % (168)	92.9	.064	54.5	.048
	≥ 10 % (99)	75.6		38.1	

OS, overall survival; DFS, disease-free survival; TACE, transarterial chemoembolization; RFA, radiofrequency ablation; E–S, Edmondson–Steiner; ICGR15, indocyanine green retention rate at 15 min.